Power Electronics Company TWERD®

Frequency Converter AFC200

0,37..3,0kW

Quick Start Guide

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manual: 04/12/2013
software: 13.0

SPECIFICATIONS

Table 0.1 – Specifications, common for frequency converters of the AFC200 series

Power	Voltage U_{in}	One-phase power : 230V -15% +10%, 45..66Hz – other voltage available
Output	Output voltage	0..U_{in} [V] / 0,00..320,00Hz – u/f mode 0..U_{in} [V] / 0,00..100,00Hz – vector mode
	Frequency resolution	0,01Hz
Control system	Modulator	SVPWM
	Operation mode	U/f (linear/squared), Vector (sensorless)
	Switching frequency	4/8/16kHz
	Rotation speed setting	Analog inputs, control panel, motopotentiometer, PI-regulator, communication unit RS485. Resolution of 0.1% for analog inputs or 0.1Hz / 1 rpm for the control panel and RS
Control inputs/outputs	Analog inputs	2 analog inputs AI1 and AI2: AI1: voltage mode 0(2)..10V, R_{in} ≥ 470kΩ AI2: current mode 0(4)..20mA, R_{in} = 500kΩ accuracy 0,5% of the full range
	Digital inputs	6 digital separated inputs 0/(15..24)V R_{in} ≥ 8kΩ
	Analog outputs	1 current output AO1: 0(4)..20mA – configuration with parameters and switches, accuracy: 0.5% of the full range
	Digital outputs	2 relays (K1, K2) – breaking capacity: 250V/4A AC
Communication	Connectors	RS485 with optoisolation
	Communication protocol	MODBUS RTU. Function 3 (Read Register); Function 6 (Write Register)
	Transmission speed	9600 or 19200 bit/s
	Application	Remote control of unit operation and programming of all parameters of the frequency converter.
Special functions	PI-regulator	Choice of referencing-unit signal source and feedback signal source, possibility of inverting polarity of an control error signal, output erasing on STOP signal, limitation of an output value
	Restore Factory Parameters	Ability to restore factory parameters of frequency inverter
Protection	Short-circuit protection	Short-circuit on unit output
	Overcurrent protection	Instantaneous value 3.5 $I_{n;}$; effective value 2.5 I_n
	Device thermal protection	Radiator's heat sensor
	Motor thermal protection	I^2t limit
	Supervision of communication through RS485	Established permissible time of connection absence
	Control of analog inputs	Check of absence of “living null” in modes 2..10V and 4..20mA

Table 0.2 - Specifications of frequency converters of the AFC200 series, depending on a type

Type of frequency converter	**Constant-torque load (overload 1.5)**		**Variable-torque load (overload 1.1[1])**		**Ip [A]**
	P_{N1} [kW]	**I_{N1} [A]**	**P_{N2} [kW]**	**I_{N2} [A]**	
AFC200-0,37kW	0,37	2,2	0,55	3,0	3,3
AFC200-0,55kW	0,55	3,0	0,75	4,0	4,5
AFC200-0,75kW	0,75	4,0	1,1	5,5	6,0
AFC200-1,1kW	1,1	5,5	1,5	7,0	8,3
AFC200-1,5kW	1,5	7,0	2,2	9,5	10,5
AFC200-2,2kW	2,2	9,5	3,0	13,0	14,5
AFC200-3,0kW	3,0***)**	13,0***)**	3,0	13,0	14,5

***) maximum overload = 1.1 I_{N1}**

P_{N1} – nominal power at allowed overload 1.5 I_n
I_{N1} – nominal output current at allowed overload 1.5 I_n
P_{N2} – nominal power at allowed overload 1.1 I_n (pumps, ventilators)
I_{N2} – nominal output current at allowed overload 1.1 I_n (pumps, ventilators)
I_P – overcurrent 60s every 10min

1) For ambient temperature <35^{0}C

1. Conditions of safe operation

1.1 Warnings

- After connecting converter to the supply network, internal circuit components (except In/Out control clamps) are on the supply network potential. Touching them can cause an electric shock.
- When you connect the converter to the supply network there is a dangerous voltage on clamps U, V, W, even when the motor does not work.
- After disconnecting the device from the supply network the dangerous voltage is still present for about 5 minutes.

1.2 Basic rules

- **Don’t make any connections when the converter AFC200 is connected to the mains.**
- **Don’t connect mains voltage to output clamps U, V, W.**
- **Don’t measure the voltage endurance of any unit devices.**
- **To measure the cables insulation it is necessary to disconnect them from the converter.**
- **Don’t touch integrated circuits and any other parts on the converter's electronic board, as they can be damaged by electrostatic discharge.**
- **Don't connect any capacitors to motor wires intended for improvement of power factor**
- **Don't measure output voltage of converter using digital voltmeter**

1.3 Operation list applied at first start-up of the system

The operations applied at installation and the first start-up of the electric drive	
✔	After unpacking the converter, it is necessary to check up visually presence of damages which could arise during transport.
✔	Check up the correspondence between the delivered frequency converter and the order - check up the ratings plate on the case. Delivery includes: the frequency converter with the User's manual
✔	Check up the correspondence between conditions in which the converter will be used and conditions of an environment for which it is designed (section 1.4).
✔	Installation of the frequency converter should be made according to principles of safety and EMC rules, listed in section 2.
✔	Choose a configuration of the frequency converter

1.4 Environmental conditions

Degree of pollution

During design second degree of pollution has been assumed, at which there are normally only non-conducting pollution. However there is a probability of temporary conductivity caused by a condensation, when the converter doesn't work.

In case the environment in which the frequency converter will work, contains pollution which can influence its safety, it is necessary to apply appropriate counteraction, using, for example, additional cases, air channels, filters etc.

Climatic conditions

Tab. 1.1 Climatic conditions

	Installation site	***During warehousing***	***During transport***
Temperature	from -10°C to +55°C[1]	from -25°C to +55°C	from -25°C to +70°C
		Protective packing	
Relative humidity	from 5% to 95%	from 5% to 95%	Max 95%
	Short-term, insignificant condensation on the external side of the converter case is permitted only when converter doesn't work.		
Air pressure	from 86 kPa to 106 kPa	from 86 kPa to 106 kPa	from 70 kPa to 106 kPa

1 For nominal load temperature 40ºC was assumed, however for lower loads higher temperatures are acceptable.

2. Installation of the frequency converter

2.1 Assembly (mechanical) drawings

Mechanical installation must be performed according to fig. 2.1. It is important to remember to keep the free space around the device for appropriate air circulation: 10 cm from above and from the bottom side and 3 cm on both sides of the device.

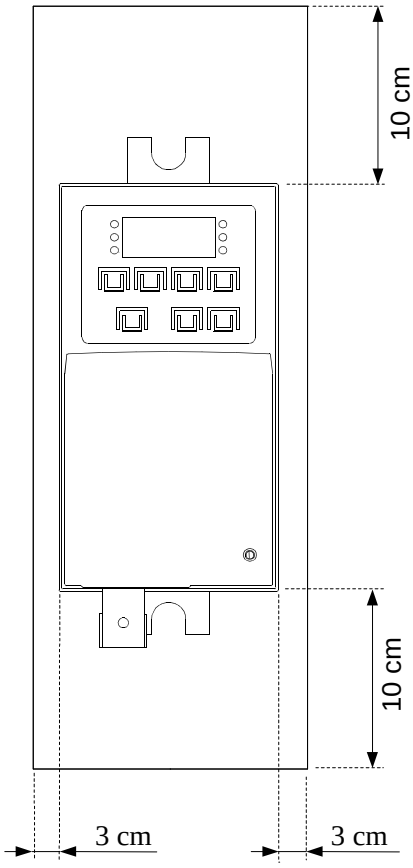


Fig. 2.1 Free space around the device

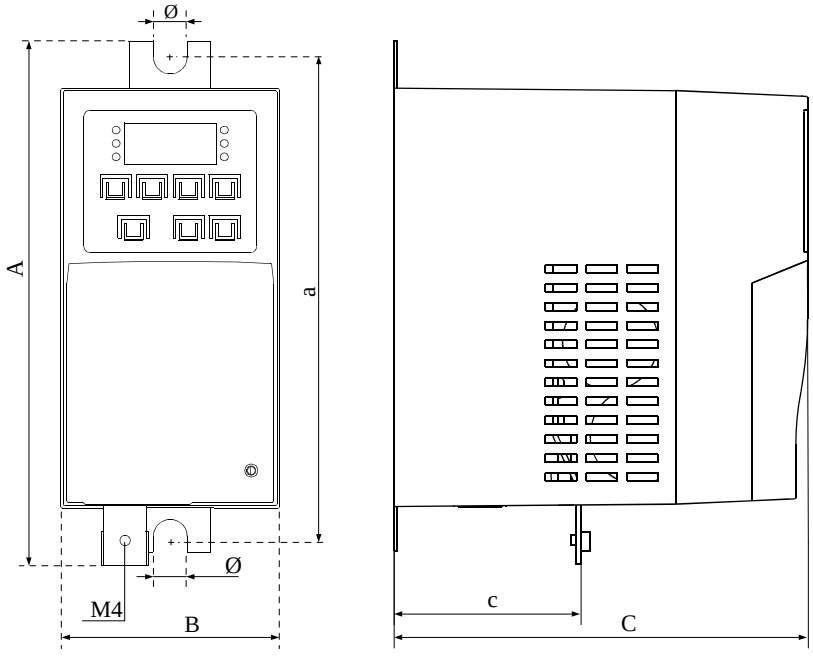


Fig. 2.2 Dimensions of AFC200 series

Tab. 2.1 Dimensions of AFC200 series

Type	Size [mm]						Weight [kg]
	A	a	B	C	c	Ø	
AFC200/0,37kW	168	151	70	133	60	7	0,80
AFC200/0,55kW							0,80
AFC200/0,75kW							0,80
AFC200/1,1kW							0,85
AFC200/1,5kW	195	174	73	169	74	7	1,30
AFC200/2,2kW							1,35
AFC200/3,0kW							1,40

2.2 Connection of a power circuits

The AFC200 converter is fed from the one-phase supply line 1x230V (AC, 50Hz). The application of a three-wire shielded cable is recommended (L1, N and PE). In the fig. 2.3 the scheme of power circuits connections is presented. Diameters of wires and protection values should be selected depending on output current of the unit.

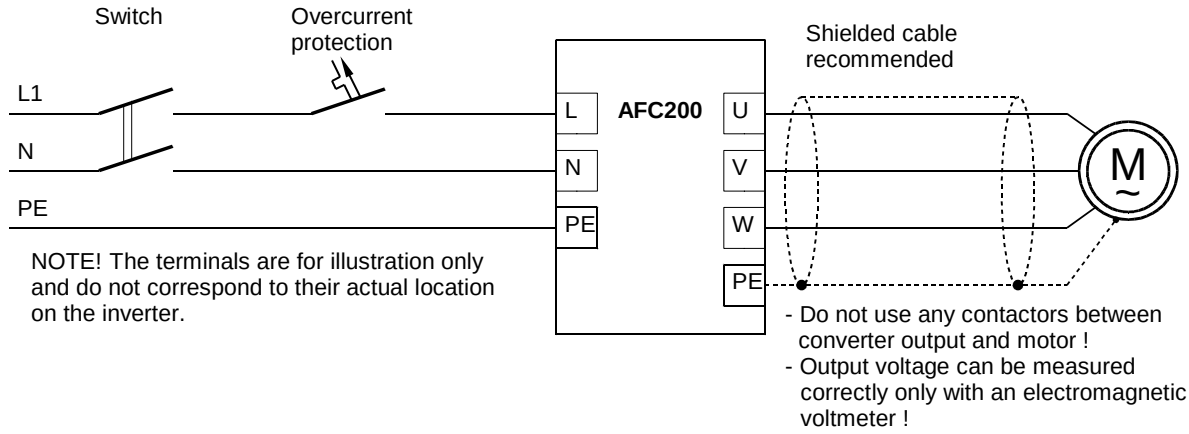


Fig. 2.3 Connection of a power circuits to MFC710 converter

2.2.1 Safety rules

Protective earthing connections

The protection against indirect touching live parts consists of automatic switching off by special short-circuit protection (or differential-current protection) or voltage limitation to a level not exceeding acceptable values, in case of an insulation failure.

The short circuit to ground at the frequency converter output can be not detected by short-circuit protection, devices due to DC link circuit. The protection against interpolar and ground short-circuit on the output of the converter is provided. However this protection is based on IGBT transistors blocking, what does not conform to the requirements of fire-prevention protection. Due to that, for safety of staff, it is necessary to make local protective connections.

In the frequency converter there are provided appropriate terminals, properly marked, protected from corrosion to make protective connections.

Protection

Use of gG or aM fuses is allowed in the circuits, however taking into account necessity of protection of the rectifier bridge of the frequency converter, the best solution is gR or aR fuses. You can use overcurrent protection, but the response time of such devices is longer than properly chosen fuse.

Frequency converter is protected from: drive overloading, motor overheating, under- and

overvoltage in an DC link circuit of the converter, a short-circuit at the converter output (it protects converter only!!).

Usage of differential-current protection due to electrical shock prevention can appear unfavorable, since it can trigger due to temporary or constant leakage current of the power drive system, working in normal conditions. In case of usage of the differential-current protection devices you may use only cut-out switches of a B type, due to different nature of a differential current.

Disconnecting device

In order to comply with EU directives, according to PN-EN 60204-1:2001, power drive, which consists of a frequency converter and electrical machine should be supplied with a device for disconnecting power supply. This device should be one of listed below:

- separator (with or without fuses), category of usage AC-23B fulfilling the requirements EN 60947-3,
- disconnector (with fuses or without), disconnecting a load circuit before opening main contacts, conforming the EN 60947-3 requirements,
- tripper conforming the EN 60947-2 requirements.

User is obliged to fulfil this requirement.

Emergency stop

In order to comply with EU directives and PN-EN 60204-1:2001 and for personnel safety and equipment, it is necessary to use an emergency stop switch, which has higher priority than other functions, irrespective of operating mode. The key STOP on operator panel cannot be treated as the switch of abnormal break, because it doesn't disconnect a frequency converter from power supply. User is obliged to fulfill this requirement.

Casing

The casing conforms to the requirements of a IP20 protection degree. The surface, on which the control panel is situated fulfills the requirements of a IP40 protection degree. The casing was designed in such a manner that it cannot be removed without usage of tools.

Capacitors discharging

In a DC link circuit of a frequency converter there is a capacitor battery with relatively high capacity. After turning off of a supply voltage in its clamps dangerous voltage is present for a certain time. It is necessary to wait for 5 minutes before making connections on clamps of power terminal strip of a frequency converter. The information about danger of such voltage is placed also on terminal strip cover.

2.3 Connection of control circuits

On fig. 2.4 user terminal block of AFC200 are presented. In the table 2.2 are the descriptions and functions of clamping rods showed.

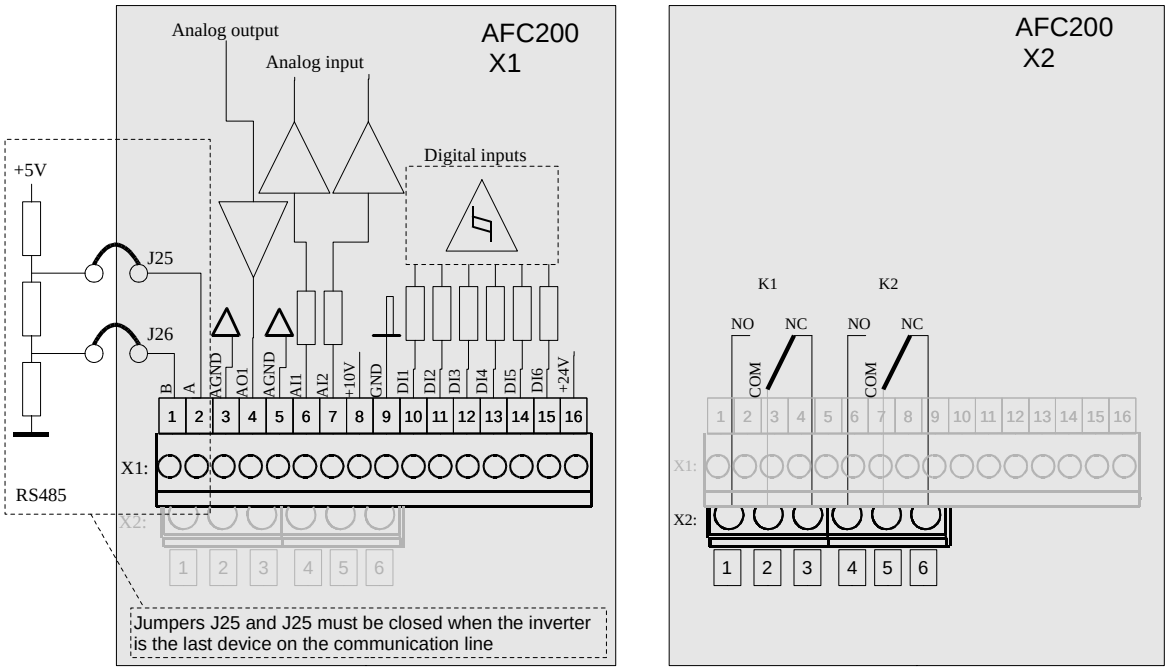


Fig. 2.4 User terminal block and configuration jumpers

Tab. *2.2 Terminal block – evaluation of inputs and outputs on the X1 block*

No	Name	Description	Notice
X1:1	B	Interface RS-485, line B	Terminator/bias are connected with jumpers J25/J26
X 1:2	A	Interface RS-485, line A	The same
X1:3	AGND	Analog Ground	Use only for connecting analog inputs/ outputs signals
X1:4	AO1	Analog Output 1 (current mode)	
X1:5	AGND	Analog Ground	Use only for connecting analog inputs/ outputs signals
X1:6	AI1	Analog Input 1 (voltage mode)	Input impedance ≥ 470 Ohm
X1:7	AI2	Analog Input 2 (current mode)	Input impedance = 500 Ohm
X1:8	+10V	Supply of external systems, i.e. potentiometer of referencing-unit	Load capacity of the source: 100mA
X1:9	GND	Digital Inputs Ground	
X1:10	DI1	Digital Input 1	Input impedance ≥ 8KOhm
X1:11	DI2	Digital Input 2	The same
X1:12	DI3	Digital Input 3	The same
X1:13	DI4	Digital Input 4	The same
X1:14	DI5	Digital Input 5	The same
X1:15	DI6	Digital Input 6	The same
X1:16	+24V	Supply for Digital inputs and external systems	Load capacity of the source: 200 mA

Tab.*2.3 Terminal block – evaluation of inputs and outputs on the X2 block*

No	Name	Description	Notice
X2:1	K1 (NO)	Relay input K1, contact N.O. (normally open)	Load capacity of contacts 5A/250VAC
X2:2	K1 (COM)	Relay input K1, contact COM (common)	The same
X2:3	K1 (NC)	Relay input K1, contact NC (normally closed)	The same
X2:4	K2 (NO)	Relay input K2, contact NO (normally open)	The same
X2:5	K2 (COM)	Relay input K2, contact COM (common)	The same
X2:6	K2 (NC)	Relay input K2, contact NC (normally closed)	The same

3. The control panel

On fig. 3.1 is the control panel with all functions presented.

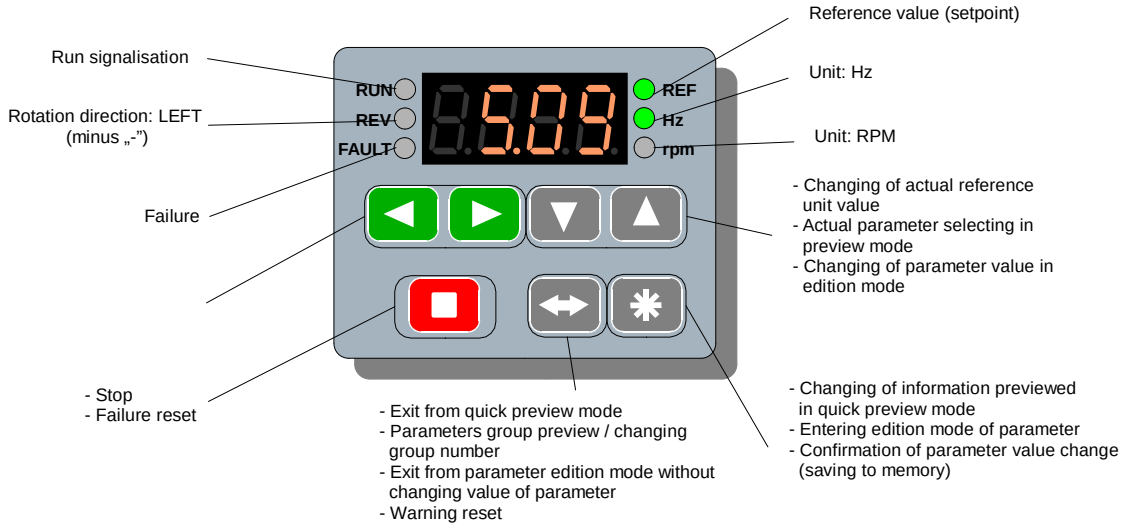


Fig. 3.1 Control panel, the basic functions of the keys

Control panel serves for constant review of the process parameters (rotational speed, current), the operating mode control (START / STOP, change of the referencing unit, cancelling fault message) and also for viewing and changing of converter's parameters. In the panel LED display.

After switching on the converter to mains, the control panel is switched on in the Base Mode.

On fig. 3.2 the main sequence of control panel service is presented.

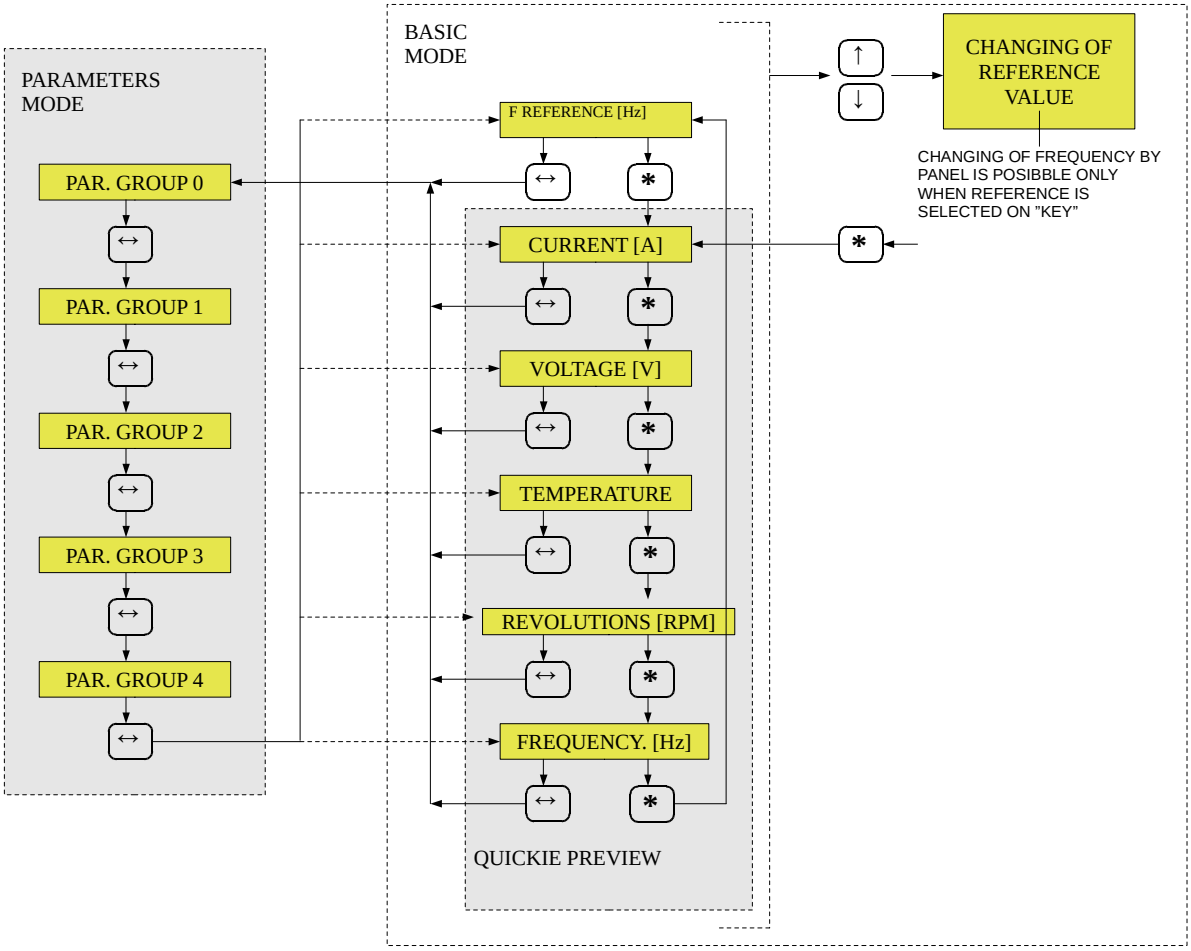


Fig. 3.2 Functional diagram of control panel operation

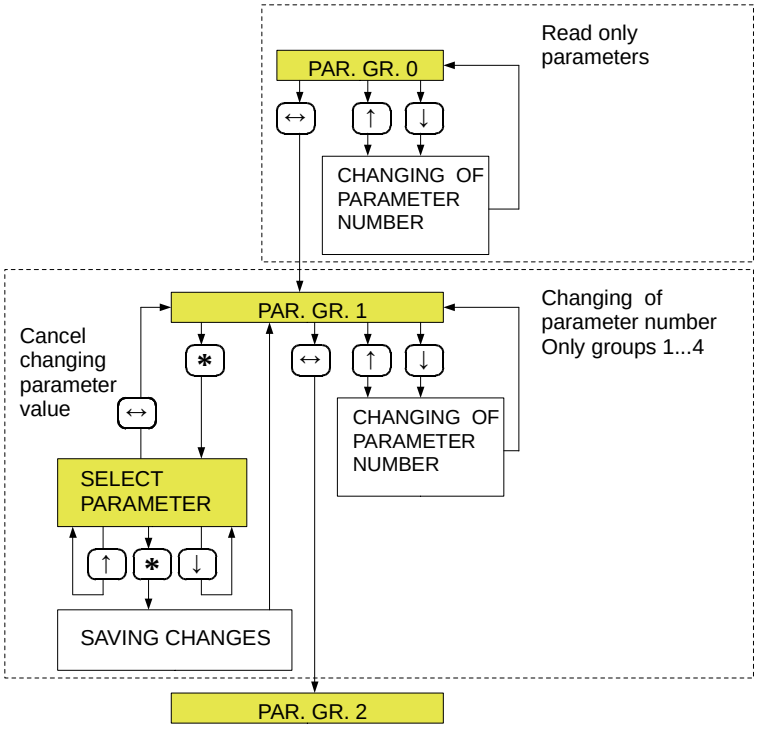


Fig. 3.3 Parameter setting

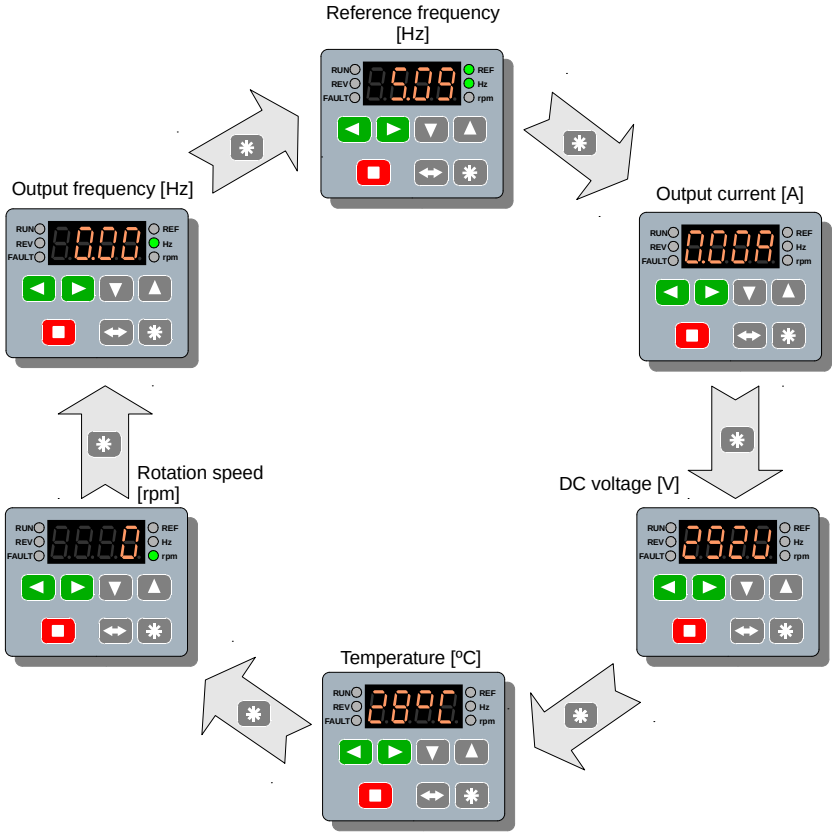


Fig. 3.4 Quick preview mode

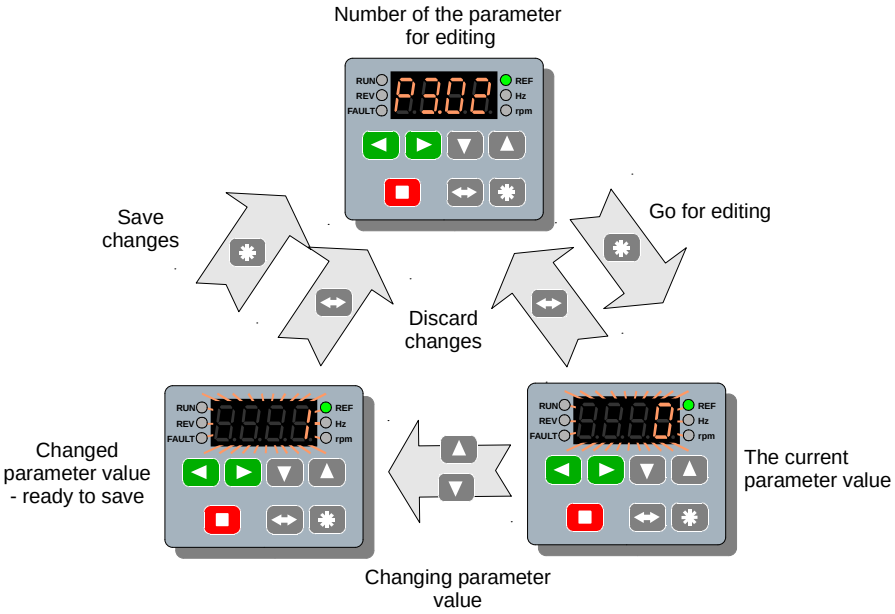


Fig. 3.5 Example of changing 3.02 parameter value from “0” to “1”

4. The First start

4.1 Connection of power circuit

Caution: Do not work on the control cables when power is applied to the drive or to the external control circuits

The connection must be done according to the fig. 2.3 on page 6:

- to the L and N terminals connect the phase conductors 1x230V, 50Hz; to the PE terminal connect PE conductor,
- to the U, V, W terminals connect the motor conductors.

After turning on the supply voltage the frequency converter will initialize.

4.2 Enter the motor data from the motor nameplate

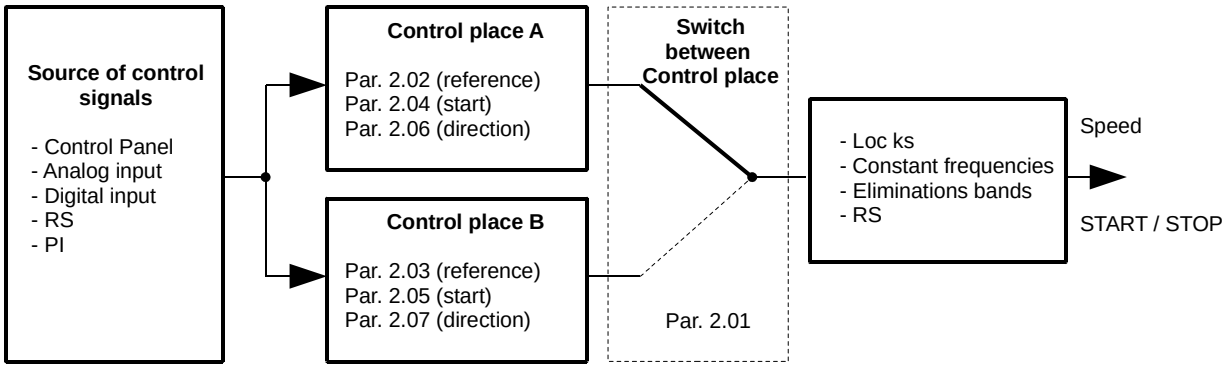
Before the first run of the frequency converter it is necessary to enter nominal parameters of a motor. Carefully read the motor data from the motor nameplate and enter to the below parameters:

par. 1.01 - nominal motor power Pn
par. 1.02 - nominal motor speed Rn
par. 1.03 - nominal motor current In
par. 1.04 - nominal motor voltage Un
par. 1.05 - nominal motor frequency fn
par. 1.06 - nominal motor power factor cos φ

After entering the motor data drive system is ready to run in a scalar U/f mode, controlled via Control Panel (described in Chapter 3 on page 9).
Acceleration time (from 0Hz to 50Hz) can be changed by par. 1.30. Deceleration time (from 50Hz to 0Hz) can be changed by par. 1.31.

5. Configuration of the frequency converter

In control system of the frequency converter AFC200 there is a philosophy of 2 independent „control places" A and B, that allows to change whole structure of the converter control (sources of START and STOP signals and sources of frequency for electric drive operation) by changing only one parameter. In fig. 4.1 there is simple diagram and in fig. 4.2 and 4.3 there are developed diagrams of the converter control.



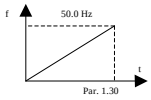
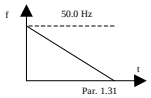
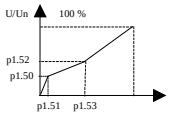
Appendix – Table of AFC200 frequency converter's parameters

Numbers of parameters which are instanced in the appendix are numbers presented on the display of the control panel. In case of reading/writing by means of RS connection, each parameter is read/written using a specified registry. For example the register 42002 corresponds to parameter 2.02 there, the register 44030 corresponds to parameter 4.30, etc.

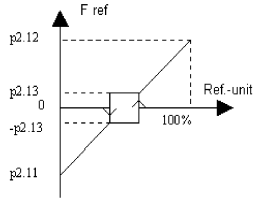
Parameters of GROUP 0. *Variables of process - only for reading. It is possible to program the control panel to display value of any of these parameters without need to enter mode of parameters viewing (section 3).*

Parameter	Name	The description
0.02	Motor n	Current rotation speed of the drive in rotations per one minute [rpm] – only in Vector mode
0.04	f out	Current output frequency of the converter [Hz] – only in scalar U/f mode
0.05	f Ref.	Referenced frequency [Hz]
0.06	Mot torque	The moment of the drive compared to the nominal moment [%]
0.07	Mot. cur.	Average value of current in windings of the drive [A]
0.08	Mot. volt.	An output voltage AC of the converter [V] (voltage of the drive)
0.10	DC volt.	Voltage of the DC intermediaries circuit of the converter [V]
0.14	Ia cur.	Current of a phase A of the drive [A]
0.15	Ib cur.	Current of a phase B of the drive [A]
0.16	Ic cur.	Current of a phase C of the drive [A]
0.23	Hts. temp.	Temperature of the heat sink (or IGBT module)
0.30	PI Ref.	Value of current referencing-unit of the PI-regulator [%]
0.31	PI In.	Current input value of the PI-regulator [%]
0.32	PI error	Error of the PI-regulator [%]
0.33	PI Out.	Current output value of the PI- regulator [%]
0.35	ON time	Total work time of the frequency converter [h]
0.40	AI1	Value of an analog input 1 [%]
0.41	AI2	Value of an analog input 2 [%]
0.43	AO1	Value of an analog output 1 [%]
0.45	Ref. A1	Value of the analog referencing-unit 1 [%]
0.46	Ref. A2	Value of the analog referencing-unit 2 [%]
0.48	DI state	State of all six digital inputs (for RS six youngest bits of the register)
0.50	RS1 state	Corresponds to the value written into the register 2000 through RS connection
0.51	Version	Version of the keyboard software
0.52	RS Ref.	RS referencing-unit. Corresponds to the value written into the register 2001 through RS [Hz] or [rpm]
0.53	RS PI Ref.	RS PI Ref.-unit. Corresponds to the value written into the register 2002 through RS [%]

Parameter / Name	Function	Available options / measurement unit / comments	Factory setting	Change during operating time
GROUP 1 – CONFIGURATION OF THE DRIVE				
1.01 Pn	Nominal power of the electric motor	0.0 ... 3.0 kW	Nominal power of the frequency converter	NO
1.02 Rn	Nominal motor speed	0 ... 9999 rpm	1450 rpm	NO
1.03 In	Nominal motor current	0.00 ...30 A	Nominal power of the frequency converter	NO
1.04 Un	Nominal motor voltage	0 ... 999 V	230 V	NO

Parameter / Name	Function	Available options / measurement unit / comments	Factory setting	Change during operating time
1.05 fn	Nominal motor frequency	0.0 ... 320.0 Hz	50.0 Hz	NO
1.06 PF nom.	Nominal cos φ_n of the motor	0.50 ... 1.00	0.80	NO
1.10 ID run	Identification of motor's equivalent circuit parameters	0 - without identification 1 - start the identification procedure – necessary to work in vector mode (must be performed individually for each used motor)	0	NO
1.11 Rs	Resistance stator windings	0 ... 300,0 Ohm		NO
1.20 Operating mode	Frequency converter operating mode	0 - linear U/f scalar mode 1 - square-law U/f scalar mode 2 - not used 3 - vector mode (please read section 5.5 before using this mode)	0	NO
1.21 f carrier	Switching frequency	0 - 4kHz 1 - 8kHz 2 - 16kHz	0	NO
1.30 Acceleration	Acceleration time from 0 Hz to 50 Hz	0.0 ... 320.0 s 	5.0 s	YES
1.31 Deceleration	Deceleration time from 50Hz to 0Hz	0.0 ... 320.0 s 	5.0 s	YES
1.37 Initiation time	Time from power up after which you can start the converter	0...200s	0 s	YES
1.38 Stop delay	Delaying of the beginning stop procedure	0...200s	0 s	YES
1.40 f max	Maximum output frequency	0.0 ... 320.0 Hz *Note: does not limit referenced frequency f Ref. Please look also at par. 2.12*	55.0 Hz	YES
1.41 I limit M	Current restriction at motor operation	0.0 ... 200.0 % motor In	150.0 %	YES
1.43 T limit M	Torque restriction at motor operation	0.0 ... 200.0 % motor Mn	150.0%	YES
1.50 U0	Voltage for output frequency F0 (par. 1.51)	0.0 ... 40.0 % motor Un 	2.0 %	YES
1.51 F0	F0 frequency	0.0 ... 20.0 %	0.0 %	YES
1.52 U1	Voltage for output frequency F1 (par 1.53)	0.0 ... 40.0 %	20.0 %	YES
1.53 F1	F1 frequency	0.0 ... 25.0 %	25,0 %	YES
1.60 Slip comp.	Slip compensation	0 - NO – slip compensation disabled 1 - YES – slip compensation enabled	0	YES
1.64 Stop mode	Stopping by coast or according to characteristic	0-Coast – stopping by running out after STOP command (voltage taken off immediately) 1-Ramp – deceleration to 0 Hz at first, then shutting down	0	YES
1.65 Dir. Block	Blocking direction of rotation	0 - Reversal – bidirectional 1 - LEFT 2 - RIGHT	0	YES
1.70 Amp. reg.n	Speed regulator gain	0..5000	60	NO
1.71 Ki of reg.n	Integration time of speed regulator	0..5000	40	NO
1.72 Amp. reg.T	Torque regulator gain	0..5000	30	NO

Parameter / Name	Function	Available options / measurement unit / comments	Factory setting	Change during operating time
1.73 Ki of reg.T	Integration time of Torque regulator	0..5000	130	NO
1.74 Amp. reg.S	Motor stream regulator gain	0..5000	60	NO
1.75 Ki of reg.S	Integration time of motor stream regulator	Service parameter	100	NO
1.90 F elim1 min	Minimum frequency of frequency elimination range number 1	0.00 ... 320.0 Hz	0.00 Hz	YES
1.91 F elim1 max	Maximum frequency of frequency elimination range number 1	0.00 ... 320.0 Hz	0.00 Hz	YES
1.92 F elim2 min	Minimum frequency of frequency elimination range number 2	0.00 ... 320.0 Hz	0.00 Hz	YES
1.93 F elim2 max	Maximum frequency of frequency elimination range number 2	0.00 ... 320.0 Hz	0.00 Hz	YES
1.94 F elim3 min	Minimum frequency of frequency elimination range number 3	0.00 ... 320.0 Hz	0.00 Hz	YES
1.95 F elim3 max	Maximum frequency of frequency elimination range number 3	0.00 ... 320.0 Hz	0.00 Hz	YES
GROUP 2 – REFERENCING-UNITS AND CONTROL				
2.01 B Ctrl.unit	Switching on variant A or B of control	*software version: 13.0 and higher* 0 – Control A 1-DI1, 2-DI2 .. 6-DI6 – A/B selection using the digital inputs DI (0V→ Control A, 24V→ Control B) 7 – Control B *software version: 12.0 and lower* 0 – Control A 1 – Control B	0	YES
2.02 Ref.unit A	Choice of a referencing-unit for Control A	0 - Keyb. – frequency ref.-unit from the panel 1 - AI1 – referencing frequency by signal from analog input 1 2 - AI2 – referencing frequency by signal from analog input 2 3 - not used 4 - OutPI – referencing frequency by PI-regulator 5 - MotPot – referencing by increase/decrease signals from motopotentiometer 6 - RS – referencing through RS485 connection (Modbus) 7 - RefA1 8 - RefA2	0	YES
2.03 Ref.unit B	Choice of a referencing-unit for Control B		1	YES
2.04 Start A	Choice of a source of START / STOP signal for Control A	0 - DI – remote START/STOP control (from device's digital inputs – see par 2.8) 1 - Keyb. – local START/STOP control from the panel 2 - RS – START/STOP control through RS485 (Modbus)	1	YES
2.05 Start B	Choice of a source of START / STOP signal for Control B		0	YES
2.06 Dir. A	Choice of signal of direction control for Control A		1	YES
2.07 Dir. B	Choice of signal of direction control for Control B		0	YES
2.08 Remote Start	Variant of START/STOP remote control	0 – DI1 = START/STOP, DI2 = direction 1 – DI1 = START RIGHT, DI2 = START LEFT 2 – impulse DI1 = START, impulse DI2 = STOP 3 – as above, DI3 = direction 4 – DI1 = START/STOP 5 – DI1 or DI2 = START/STOP 6 – DI1 and DI2 = START/STOP	0	YES

Parameter / Name	Function	Available options / measurement unit / comments	Factory setting	Change during operating time
2.11 Ref. min	Referenced frequency which corresponds to 0% of the referencing-unit	-320.0 ... 320.0 Hz 	0.00 Hz	YES
2.12 Ref. max	Referenced frequency which corresponds to 100% of the referencing-unit	-320.0 ... 320.0 Hz *see also par. 1.40 f max*	50.00 Hz	YES
2.13 F Stop	Minimal absolute value of referenced frequency	0.00 ... 55.00 Hz	0.00 Hz	YES
2.14 Use f stop	Stopping when f < par 2.13	0 – device will stop, if referenced F is lower than minimum determined by par 2.13 1 – device will only limit frequency to par 2.13	0	YES
2.20 Motopot.up	Source of "increase" signal for motopotentiometer referencing-unit	0 - OFF (1 - DI1)...(6 - DI6) – increase ref.-unit, when there is a voltage supplied on digital input 1...6	0	YES
2.21 Motopot.dwn	Source of "decrease" signal for motopotentiometer ref.-unit	0 - OFF (1 - DI1)...(6 - DI6) – decrease ref.-unit, when there is a voltage supplied on digital input 1...6	0	YES
2.22 Motop.mode	Motopotentiometer mode	0 – pushing STOP button causes resetting of motopotentiometer settings 1 – value of motopotentiometer setting is stored in memory. There is no possibility of changing this setting during stoppage 2 – value of current referencing-unit setting traced by motopotentiometer. Applied for gentle transmission from current ref.-unit to motopotentiometer 3 – value of motopotentiometer setting stored in the memory. There is a possibility of changing this setting during stoppage	0	YES
2.23 Motop. time	Time of increase/decrease of motopotentiometer ref.-unit	0.0 ... 320.0 s	10.0 s	YES
2.24 DI1 Logic	Logic of digital input DI1	0 - no negation 1 - negation	0	YES
2.25 DI2 Logic	Logic of digital input DI2	0 - no negation 1 - negation	0	YES
2.26 DI3 Logic	Logic of digital input DI3	0 - no negation 1 - negation	0	YES
2.27 DI4 Logic	Logic of digital input DI4	0 - no negation 1 - negation	0	YES
2.28 DI5 Logic	Logic of digital input DI5	0 - no negation 1 - negation	0	YES
2.29 DI6 Logic	Logic of digital input DI6	0 - no negation 1 - negation	0	YES
2.30 FConst0 src	Source of W1 signal for referencing constant speeds	„0" – W1=0 1 (DI1)..6 (DI6) – W1=1 when there is voltage supplied on digital input DI1..DI6	0	YES
2.31 FConst1 src	Source of W2 signal for referencing constant speeds	as above	0	YES
2.32 FConst2 src	Source of W3 signal for referencing constant speeds	as above	0	YES
2.33 F Const 1	Constant frequency 1	0.00 ... 320.0 Hz	10.00 Hz	YES
2.34 F Const 2	Constant frequency 2	0.00 ... 320.0 Hz	20.00 Hz	YES

Parameter / Name	Function	Available options / measurement unit / comments	Factory setting	Change during operating time
2.35 F Const 3	Constant frequency 3	0.00 ... 320.0 Hz	25.00 Hz	YES
2.36 F Const 4	Constant frequency 4	0.00 ... 320.0 Hz	30.00 Hz	YES
2.37 F Const 5	Constant frequency 5	0.00 ... 320.0 Hz	40.00 Hz	YES
2.38 F Const 6	Constant frequency 6	0.00 ... 320.0 Hz	45.00 Hz	YES
2.39 F Const 7	Constant frequency 7	0.00 ... 320.0 Hz	50.00 Hz	YES
2.40 Cfg. AI1	Configuration of analog input AI1 (voltage mode)	0: 0-10 V (0 V = 0.0 %, 10 V = 100.0%) 1: 10-0 V (10 V = 0.0 %, 0 V = 100.0%) 2: 2-10 V (2 V = 0.0 %, 10 V = 100.0%) 3: 10-2 V (10 V = 0.0 %, 2 V = 100.0%)	0	YES
2.41 Cfg. AI2	Configuration of analog input AI2 (current mode)	0: 0-20 mA (0 mA = 0.0 %, 20 mA = 100.0%) 1: 20-0 mA (20 mA = 0.0 %, 0 mA = 100.0%) 2: 4-20 mA (4 mA = 0.0 %, 20 mA = 100.0%) 3: 20-4 mA (20 mA = 0.0 %, 4 mA = 100.0%)	0	YES
2.43 AI1 Scale	Scale of analog referencing-unit RefA1	-500.0 ... 500.0 %	100.0 %	YES
2.44 AI2 Scale	Scale of analog referencing-unit RefA2	-500.0 ... 500.0 %	100.0 %	YES
2.46 AI1 Offs.	Offset of analog referencing-unit RefA1	-500.0 ... 500.0 %	0.0 %	YES
2.47 AI2 Offs.	Offset of analog referencing-unit RefA2	-500.0 ... 500.0 %	0.0 %	YES
2.49 AI1 Fltr.	Constant of time of low-pass filter	0.00 ... 50.00 s	0.10 s	YES
2.50 AI2 Fltr.	Constant of time of low-pass filter	0.00 ... 50.00 s	0.10s	YES
2.60 PI Ref.Src	Choice of PI-regulator referencing-unit	0 - Keyb. – referencing frequency from panel 1 - AI1 – referencing frequency by signal from analog input AI1 2 - AI2 – referencing frequency by signal from analog input AI2 3 - not used 4 - RS: – referencing through RS485 link	0	YES
2.61 PI Inp.Src	Choice of regulated value of PI-regulator	0 - RefA1 – referencing regulated value from analog referencing-unit RefA1 1 - RefA2 – referencing regulated value from analog referencing-unit RefA2	0	YES
2.62 Error inv.	Negation of regulator's error	0 - NO 1 - YES	0	YES
2.63 P Amp.	Amplification of proportional element of PI regulator	0 ... 3000 %	100 %	YES
2.64 I Const.	Constant of time I of the PI regulator	0.00 ... 320.0 s	0.10 s	YES
2.66 max.Out.PI	Upper limitation of PI-regulator output value	0,0 ... 300,0 %	100.0 %	YES
2.67 min.Out.PI	Lower limitation of PI-regulator output value	-300,0 ... 0,0 %	0.0 %	YES
2.68 PI Out.res	Resetting PI output when device is stopped	0 – reset on STOP 1 – regulator continuously active	0	YES
2.80 AO1 Src.	Choice of signal for analog output AO1	0 - rpm – speed with a sign 0.0 % = -Nn, 50.0 % = 0, 100.0 % = Nn 1 - | rpm | – speed without a sign 0 % = 0, 100 % = Nn 2 - F out. – output frequency 100.0 % = Fn 3 - Cur. – output current 100.0 % = In 4 - | load | – load without a sign 100.0 % = 2Mn 5 - load – load with a sign 100 % = 2Mn, 50 % = 0, 0 % = -2Mn 6 - U mot. – output voltage 100.0 % = Un	2	YES

Parameter / Name	Function	Available options / measurement unit / comments	Factory setting	Change during operating time
2.82 AO1 Cfg.	Configuration of analog output AO1 (current mode)	0: 0-20 mA (0 mA = 0.0 %, 20 mA = 100.0%) 1: 20-0 mA (20 mA = 0.0 %, 0 mA = 100.0%) 2: 4-20 mA (4 mA = 0.0 %, 20 mA = 100.0%) 3: 20-4 mA (20 mA = 0.0 %, 4 mA = 100.0%)	0	YES
2.84 AO1 Scal	Scale of analog output AO1	0.0 ... 500.0%	100.0 %	YES
2.86 AO1 Fltr	Constant of time of low-pass filter AO1	0.01 ... 50.00 s	0.10 s	YES
2.90 K1 funct. 1	Function 1 of K1 relay	0 - NotAct – relay not active 1 - Work – active when there is voltage supplied to motor 2 - Ready – device is ready to work 3 - Fail. – a failure has occurred 4 - n.Flr. – no failure 5 – not used 6 – not used 7 - Fthr1 – F threshold 1 exceeded 8 - Fthr2 – F threshold 2 exceeded 9 - Fref – referenced frequency reached 10 - Temp.Wr – warning of exceeding programmed threshold of radiator temperature 11 - An.Wrn. – warning: error of analog signal (lack of "living null" signal lower than 2V or 4mA) 12 - ActDI1 – Digital input DI1 is active 13 - ActDI1-2 – Digital input DI1 or DI2 is active 14 - ActDI1-3 – Digital input DI1 or DI2 or DI3 is active	2	YES
2.91 K1 funct. 2	Function 2 of K1 relay	as above	0	YES
2.92 K2 funct. 1	Function 1 of K2 relay	as above	0	YES
2.92 K2 funct. 2	Function 2 of K2 relay	as above	0	YES
2.98 f thresh. 1	Threshold frequency 1	0.00 ... 320.0 Hz	25.00 Hz	YES
2.99 f thresh. 2	Threshold frequency 2	0.00 ... 320.0 Hz	45.00 Hz	YES
2.100 Temp.Warn	Threshold of radiator overheat warning	0 ... 80 °C	70 °C	YES
2.110 Op. Perm.	External operation permission	0 - Off – operation not allowed 1-DI1..6-DI6 – operation allowed, when there is a voltage supplied on digital input DI1...DI6 7-On - operation allowed	7	YES
GROUP 3 – FAILURES				
3.02 i^2t Block.	Switching on blocking from thermal overload	0 - NO – disabled 1 - YES – enabled	0	NO
3.03 I therm.	Setting of drive thermal protection current	0.0 ... 200.0 %	100.0 %	NO
3.04 I therm.0	Setting of thermorelay for stopped drive	0.0 ... 200.0 %	50.0 %	NO
3.05 therm. Const.	Constant of drive heating	0 ... 320 min.	3 min	NO
3.10 Ext. fail.	Choice of external failure source	0 - Off – disabled 1-DI1..6-DI6 – reporting external failure, when there is a voltage supplied on digital input DI1..DI6	0	YES
3.23 Re.4mA lack	Response to lack of analog signal - level <2V (4mA)	0 - No – no response 1 - Warn. – a warning will be displayed, device keeps working with last referenced frequency 2 - Fail. – the device will stop and the indication of failure will be displayed *Note: the system has a deadband from 2.0..1.0V and 4..2mA*	0	YES
3.60 Re. RS lack	Response to lack of communication through RS link	0 - No – no response 1 - Fail. – the device will stop and the indicator of failure will be displayed	0	YES
3.61 RSlack time	Acceptable time of lack of communication through RS link	1 ... 600 s	30 s	YES

Parameter / Name	Function	Available options / measurement unit / comments	Factory setting	Change during operating time
3.70 Ext. reset	Source of external reset	0 - Off – no possibility of external erasing a failure 1-DI1..6-DI6 – erasing a failure by digital input DI1..DI6	4	YES
3.80 Failure 1	Failure Register 1 (the most current record)	Indication of failure		Read only
3.81 Fa.1 time	Register of time of occurrence of failure from Failure Register 1	Time [h]		Read only
...	...	...		...
3.110 Failure 16	Failure Register 16 (the oldest record)	Indication of failure		Read only
3.111 Czas Aw.16	Register of time of occurrence of failure from Failure Register 16	Time [h]		Read only
GROUP 4 – PARAMETERS BLOCKING, CONFIGURATION OF: RS, DISPLAYING AND USER REFERENCING-UNITS				
4.02 Level/CODE	Access level (reading) Access code (writing)	Access level **AL0 ... AL2** Access code 0 ... 5000 *default access code for access level AL1 = 14* *default access code for access level AL2 = 15*	2	YES
4.03 New CODE	Change of access code to current access level	New access code 0 ... 5000	0	YES
4.04 Fact. set.	Restore factory settings	0 – not active 1 – restore factory settings of the drive (access level AL2 required)	0	NO
4.07 RS perm.	Permission to work through RS	0 - Off – operation through RS prohibited 1-DI1.. 6-DI6 – enabling RS permission by digital input 7 - On – operation through RS permitted	7	YES
4.08 RS baudrate	Transmission speed	0 - 9600 bits / s 1 - 19200 bits / s 2 – 38400 bits / s	0	YES
4.09 Unit no.	Identification number of Modbus device	0 ... 247	12	YES
4.10 L1 at STOP	Value displayed when device is not working	2-par 0.02 ... 48-par 0.48	5	YES
4.11 L1 at START	Value displayed when device is working	2-par 0.02 ... 48-par 0.48	5	YES